Forest insect and disease conditions in Newfoundland and Labrador in 1990

L.J. Clarke, W.J. Sutton, E.C. Banfield, D.M. Stone, D.S. O'Brien, K.E. Pardy, G.C. Carew and A.G. Raske

Newfoundland and Labrador Region • Information Report N-X-283

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INFORMATION REPORT N-X-283
1992

FORESTRY CANADA
NEWFOUNDLAND & LABRADOR REGION

92-07022/

©Minister of Forestry 1992

ISSN NO. 0704-7657
CAT. NO. Fo46-15/283E
ISBN NO. 0-662-19322-9

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Printed in Canada

ABSTRACT

This report summarizes forest pest conditions in Newfoundland and Labrador in 1990 and forecasts infestations of major defoliators for 1991. Summaries were compiled from information collected by Forest Insect and Disease Survey staff in 12 districts of the Province.

Infestations of the **hemlock looper** decreased to 16 000 ha in 1990, including 2 600 ha of moderate and severe defoliation. The infestation is forecast to cause defoliation in 1991 of 19 100 ha, including 8 000 ha of moderate and severe defoliation. Moderate and severe defoliation, caused by the **blackheaded budworm** decreased to 22 000 ha in 1990, including 7 500 ha of moderate and severe defoliation. About 77 500 are forecast to be moderately and severely defoliated in 1991.

The size of the infestation of the **spruce budworm** increased in 1990 to 1 300 ha of moderate and severe defoliation, and an additional 900 ha was classed as light. However, the number of male moths caught in pheromone traps throughout the Province decreased to 1 452 in 1990. About 6000 ha of moderate and severe defoliation is forecast for 1991, and 27 500 ha of light defoliation. Of special concern is the general population rise, within endemic populations, in many localities in western Newfoundland.

Areas of defoliation by the **balsam fir sawfly** increased to 6 200 ha of balsam fir and included 1 900 ha of light defoliation. The population survey of the **balsam woolly adelgid** was completed in 1990, and high population levels of more than 10 adelgids/node occurred in all three major regions of the Island. A total of 11 other insect species and 9 diseases caused minor forest damage.

RÉSUMÉ

Le rapport résume la situation des insectes et des maladies des arbres à Terre-Neuve et au Labrador en 1990 et présente les prévisions d'infestation par les principaux défoliateurs pour 1991. Des résumés ont été établis à partir des données recueillies dans 12 districts de la province par le personnel du Relevé des insectes et des maladies des arbres.

En 1990, les secteurs infestés par l'**arpenteuse de la pruche** ont diminué pour atteindre 16 000 ha, y compris 2 600 ha modérément et gravement défoliés. En 1991, l'infestation par ce ravageur devrait entraîner la défoliation de 19 100 ha, y compris 8 000 ha modérément et gravement défoliés. La défoliation modérée et grave causée par la **tordeuse à tête noire** a diminué, passant à 22 000 ha en 1990, y compris les 7 500 ha modérément et gravement défoliés. Près de 77 500 ha devraient être modérément et gravement défoliés en 1991.

Le territoire infesté par la **tordeuse des bourgeons de l'épinette** a augmenté en 1990 pour atteindre 1 300 ha de défoliation modérée et grave et un autre 900 ha de défoliation légère. Le nombre de papillons mâles capturés dans les pièges à phéromone a toutefois diminué dans l'ensemble de la province pour atteindre 1 452 en 1990. En 1991, la superficie modérément et gravement défoliée devrait être de 6 000 ha et celle légèrement défoliée, de 27 500 ha. La hausse générale des populations endémiques est particulièrement préoccupante dans de nombreux endroits de l'ouest de Terre-Neuve.

Les superficies défoliées par le **diprion du sapin** ont augmenté pour atteindre 6 200 ha de sapins baumiers, y compris 1 900 ha légèrement défoliés. Le relevé des populations du **puceron lanigère du sapin** a été terminé en 1990 et des niveaux de population élevés (plus de 10 pucerons/nodosité) ont été observés dans les 3 grandes régions de l'île. Au total, 11 autres espèces d'insectes et 9 maladies ont causé des dégâts mineurs aux forêts.

Moose caused considerable damage to thinned stands of balsam fir and caused major concern to forest managers. High populations of the meadow vole caused 50% mortality within recent jack pine plantations and caused considerable damage to trees and shrubs in the Goose Bay, Labrador area.

Winter drying was the most severe and widespread and widespread damage of abiotic origin.

Les orignaux ont considérablement ravagé les peuplements éclaircis de sapins baumiers et ont causé beaucoup de soucis aux aménagistes. De fortes populations de campagnols des champs ont provoqué une mortalité de 50 % dans de jeunes plantations de pins gris et causé des dommages considérables aux arbres et arbustes de la région de Goose Bay, au Labrador.

La dessiccation hivernale était le facteur biotique ayant causé les dégâts les plus graves et les plus étendus.

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ACKNOWLEDGEMENTS

Information for this report is based on the results of surveys conducted by all personnel of the Forest Insect and Disease Survey and research officers of the Forest Protection Section. The cooperation of the Provincial Department of Forestry and Agriculture, providing technical assistance, inventory maps and aircraft time for insect and disease assessment and the forest industry for providing pertinent data on harvesting and silviculture operations and road networks is gratefully appreciated. We thank J.H. Rockwood for typing this report.

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INTRODUCTION

The aim of the Forest Insect and Disease Survey is to summarize the factors that decrease the health of the forests of Newfoundland and report these changes to clients at the regional and national level. Information on forest health, in the form of describing pest populations and other conditions, are disseminated through seasonal highlights, special reports, Information Reports and the Annual Report of the Forest Insect and Disease Survey. Pertinent data surveys are added in appendices.

This report provides forest managers with information of pest conditions in Newfoundland, Forest Statistics with regional information for national roll-ups, and forms a part of the historical record of pest conditions for Newfoundland. Insects, diseases, and conditions that were wide-spread in 1990, or caused considerable concern are discussed in detail in the text, whereas those of lesser importance are presented in tabular form.

The Forest Insect and Disease Survey monitored the abundance of forest pests and their damage in forested areas throughout the Island and Labrador in 1990. The extent of major pest infestations were mapped, population levels sampled and the distribution of damage surveyed to provide their status in 1990. A forecast of infestations of major defoliators is provided for 1991.

Survey personnel collected 762 insect and 182 disease samples in the 12 ranger districts (Fig. 1) and 19 Forest Management Units (Fig. 2) in the Province.

Staff change during the year was the appointment of Dr. A.G. Raske as Survey Head for the Forest Insect and Disease Survey in July 1990. Rangers remained in the same districts assigned as listed in the 1989 Annual Report. Special collections of tree cones were sent to Dr. Jean Turgeon and mountain-ash sawfly larvae to Dr. K.P. Lim.

A total of 193 hours were flown in fixed-wing aircraft and helicopters to sample inaccessible areas, to map insect defoliation and damage, and to sample egg populations to forecast infestations of major forest defoliators. ARNEWS plots and permanent sample plots were sampled and measured for damage and for annual increment.

Quantitative estimates of pest conditions were obtained whenever possible, but for various reasons some information can only be reported in qualitative terms. In this report classes of population levels or damage express the following ranges:

Trace	1% to 5%
Light	6% to 25%
Moderate	26% to 75%
Severe	70% to 100%
Extreme	100% plus additional damage

Below average temperatures and above normal precipitation, both on the Island and in Labrador, dominated in May and June causing insect development to be approximately two weeks behind the average. July was fairly warm with some record-breaking high temperatures along the east coast and heavy rains in the west caused flooding in several areas, affecting both urban and forest trees. Fall weather conditions were near average.

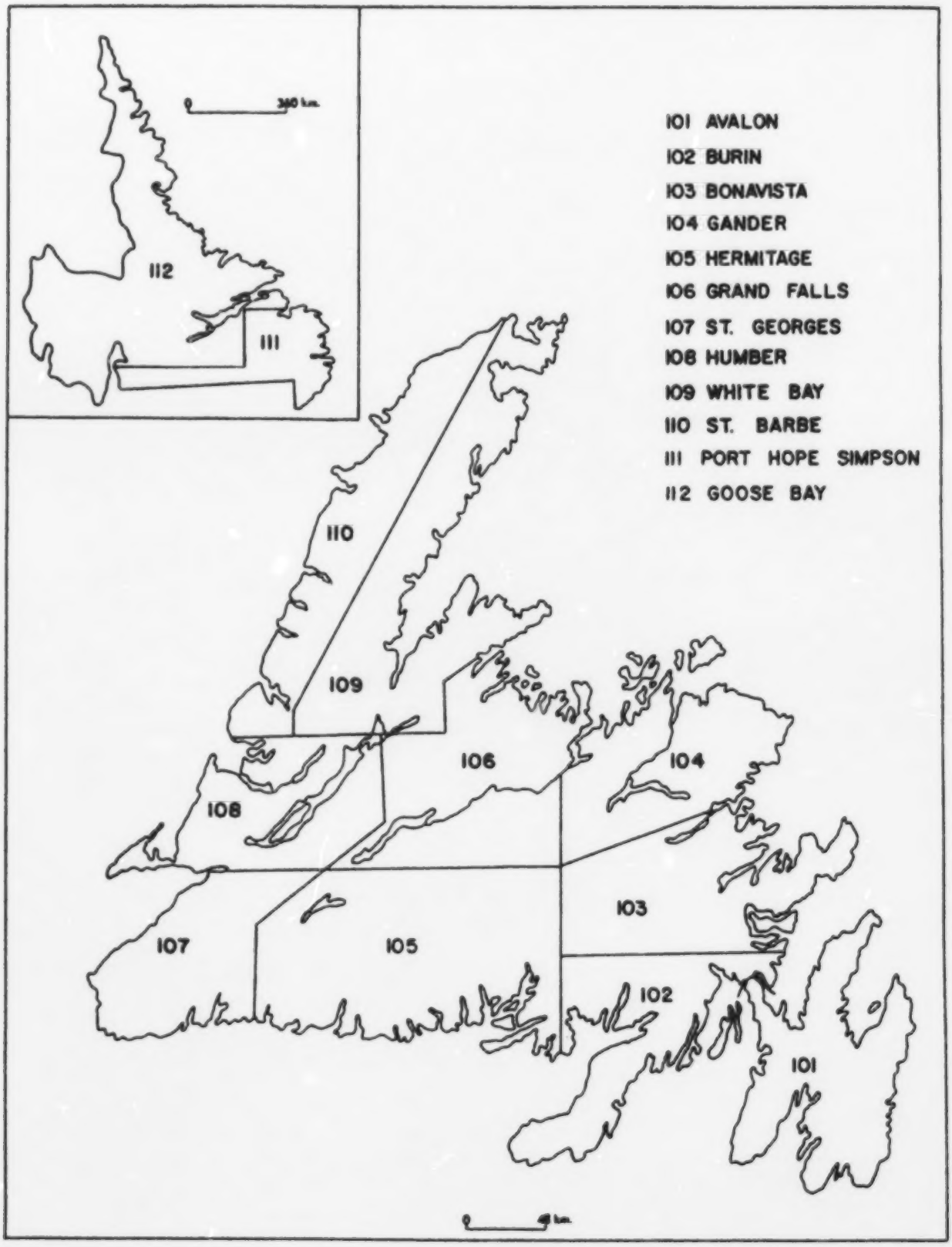

Figure 1. Forest Insect and disease Survey Districts.

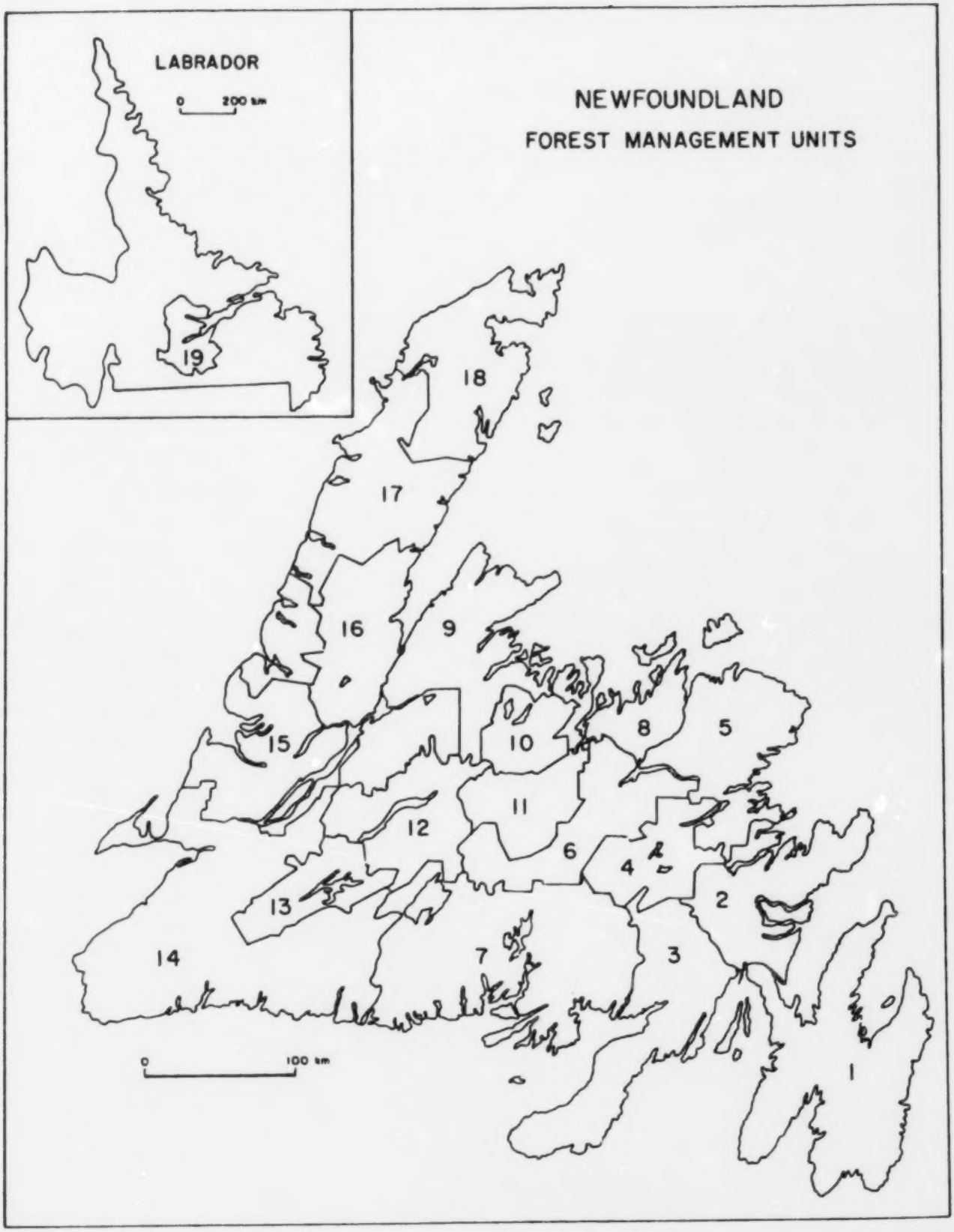

Figure 2. Newfoundland Forest Management Units.

IMPORTANT PESTS

INSECTS

Hemlock Looper
Lambdina fiscellaria

Population levels of the looper continued to decrease within the main outbreak area on the Northern Peninsula, mainly because a variable and sometimes large proportion of eggs collapsed in the spring and larvae failed to hatch. The cause of this egg mortality is unknown. Localized and small areas of infestation continued on the Avalon Peninsula but high larval numbers were killed by a fungal disease. The total area of defoliation on the Island was 16 000 ha including moderate and severe defoliation of 2 600 ha; 2 200 ha on the Northern Peninsula and 400 ha on the Avalon Peninsula (Table 1, Fig. 3).

The total area of moderate and severe defoliation decreased in size compared to 1989 and the density of looper populations within the infested areas was also generally lower.

The Department of Forestry and Agriculture treated about 13 000 ha of the infestation on the Northern Peninsula with *B.t.* at 30 BIU/ha.

Larval populations on the Northern Peninsula were sampled weekly for biological mortality factors but only eight larvae and three pupae were found on 840 branches sampled.

Of these larvae, three were parasitized and three were infested with an undetermined disease. Larvae were collected for parasite rearings from infestations on the Avalon Peninsula and 2.5% of these were parasitized. However, larval populations in several small infestations along Blackhead Road, Stiles Cove Road, Red Head Road and Three Island Pond Road on the Avalon Peninsula were greatly reduced by a fungal disease.

Overwintering egg numbers were sampled in 220 sample points from mid to late October, and the total potential areas forecast for light, moderate and severe defoliation in 1991 are about 19 100 ha, including 8 800 ha in the moderate and severe category (Table 2, Fig. 4).

Damage Assessment - The majority of tree mortality occurred on the Northern Peninsula in the vicinity of Leg Pond and along Ten Mile Lake. Several patches of trees died on the Avalon Peninsula near Shoe Cove Brook and along the coast between Portugal Cove and Bauline north of St. John's.

Table 1. Areas (ha) of defoliation caused by the hemlock looper in forested areas of Newfoundland in 1990.

	Defoliation Class*			
Management Unit No.	Light	Moderate	Severe	Total
1	300	300	100	700
17	400	8	50	458
18	12 600	600	1 600	14 800
Total	13 300	908	1 750	15 958

* Light = 6-25%
Moderate = 26-75%
Severe = 76-100%

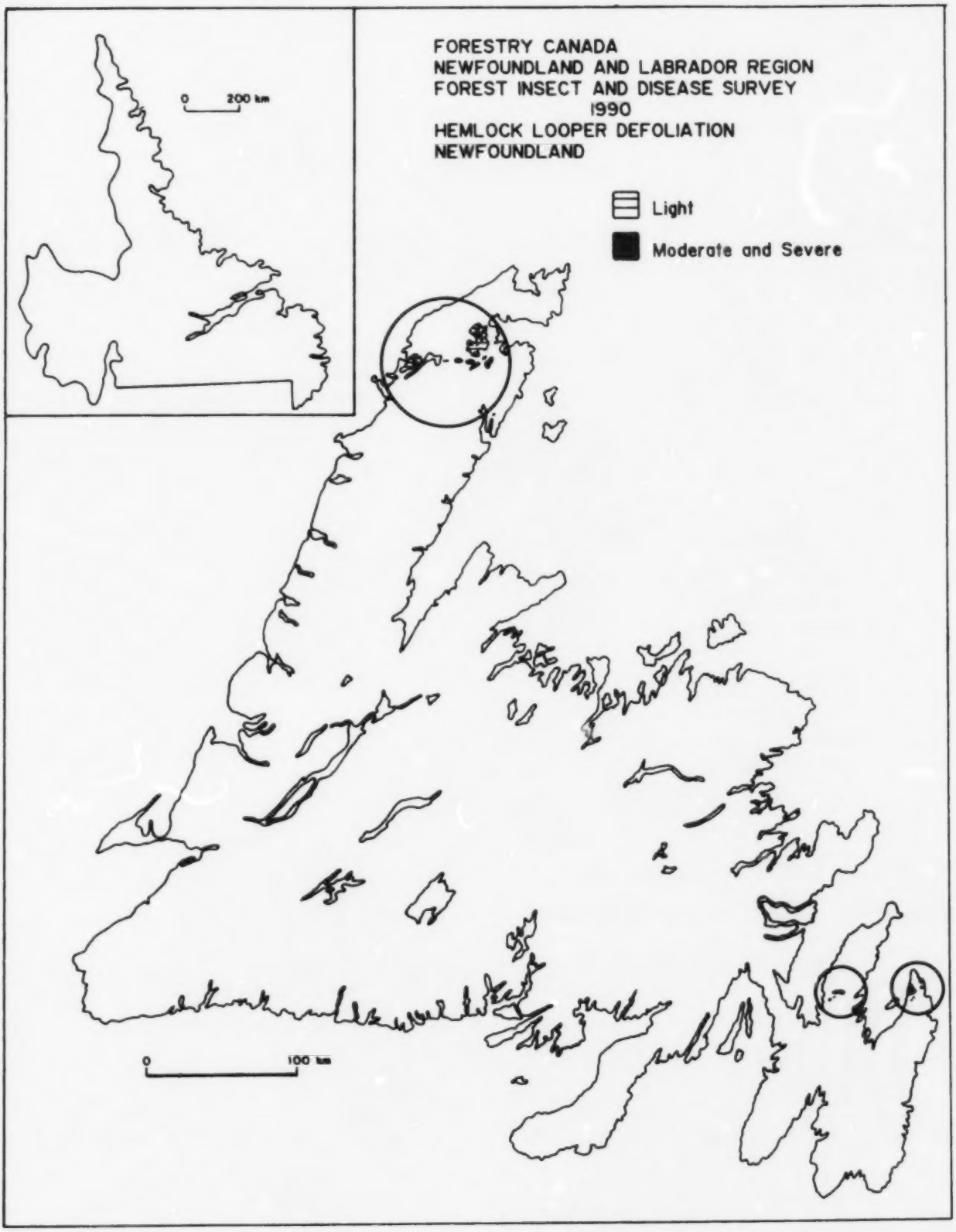

Figure 3. Areas of defoliation by the hemlock looper in forested areas of Newfoundland in 1990.

Table 2. Areas (ha) of defoliation by the hemlock looper forecast in forested areas of Newfoundland for 1991.

Management Unit No.	Defoliation Class*		
	Light[-]	Moderate and Severe[--]	Total
1	3 400	3 100	6 500
17	1 200	-	1 200
18	5 700	5 700	11 400
Total	10 300	8 800	19 100

* Light = 6-25%
Moderate = 25-75%
Severe = 76-100%

[-] Areas with low egg density (1-3 eggs/branch).
[--] Areas with moderate and high egg density (4 or more eggs/branch).

Blackheaded Budworm
Acleris variana

The outbreak of this budworm continued on the Northern Peninsula for the fifth consecutive year. In 1990 defoliation occurred in the same general area as in 1989, extending across the Peninsula from St. Barbe to Roddickton but at a lesser degree of intensity. Moderate and severe defoliation occurred mainly on overmature stands on 7 450 ha and light defoliation occurring on 14 300 ha (Table 3, Fig. 5). Blackheaded budworm defoliation by itself rarely causes tree mortality but feeding damage in association with that of the hemlock looper will cause tree mortality.

Forestry Canada in cooperation with the Provincial Department of Forestry and Agriculture tested the efficacy of *B.t.* against the blackheaded budworm. *B.t.* applied at 30 BIU/ha did not protect balsam fir foliage from defoliation by the budworm.

Table 3. Areas (ha) of defoliation caused by the blackheaded budworm in forested areas of Newfoundland for 1990.

Management Unit No.	Defoliation Class*			
	Light	Moderate	Severe	Total
17	6 200	4 100	1 800	12 100
18	8 100	1 400	150	9 650
Total	14 300	5 500	1 950	21 750

* Light = 6% - 25%
Moderate = 26% - 75%
Severe = 76% -100%

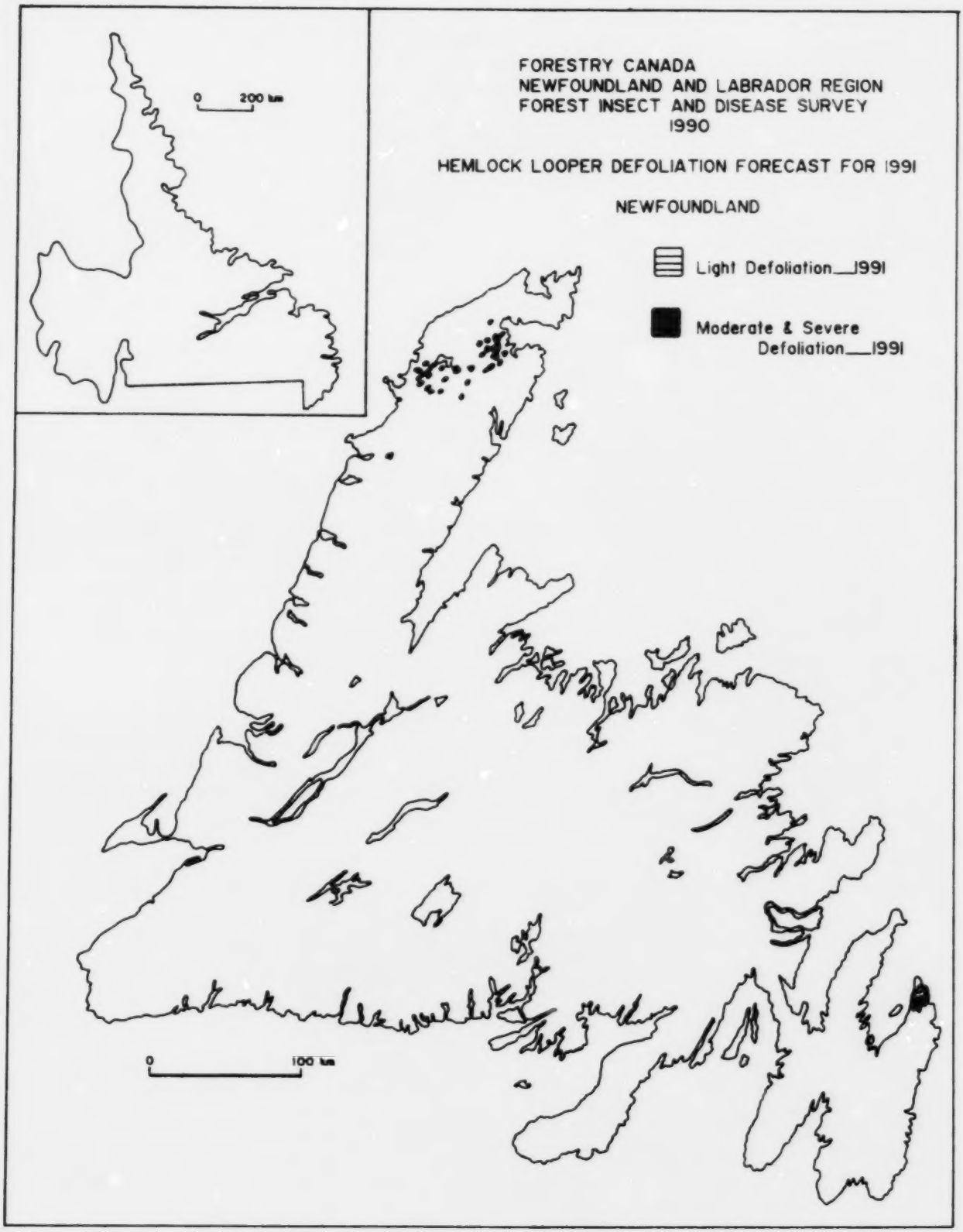

Figure 4. Areas of defoliation by the hemlock looper forecast in forested areas of Newfoundland for 1991.

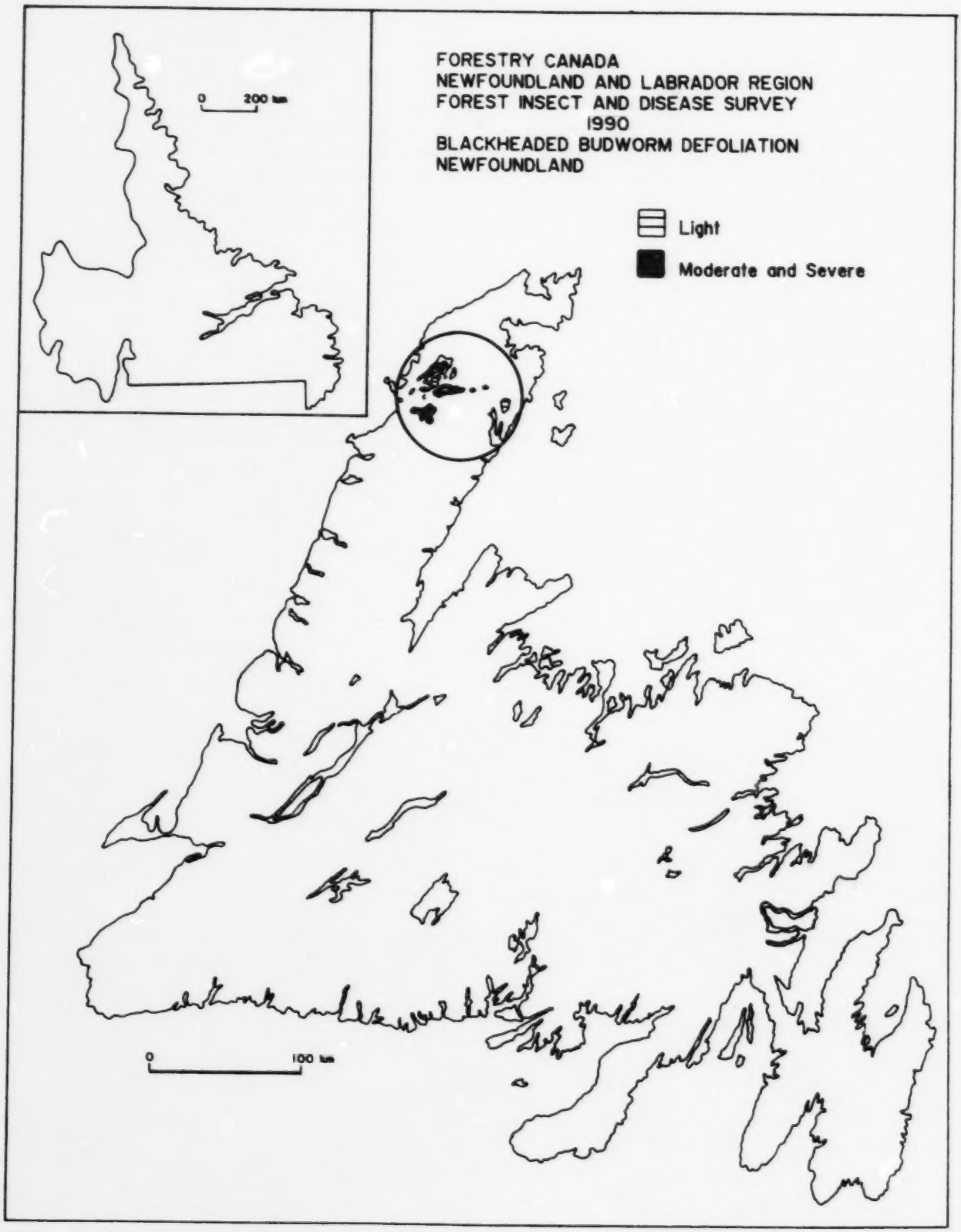

Figure 5. Areas of defoliation by the blackheaded budworm in forested areas of Newfoundland in 1990.

Larval populations were sampled for biological mortality factors in the outbreak area on the Northern Peninsula and in areas of low populations on the Baie Verte Peninsula. Approximately 1% of the eggs collected were killed by a disease. About 14% of the larvae collected were parasitized, 2% died from a fungal infection and 5% were infected by an undetermined disease. Also 5% of the pupae collected were parasitized. About 11% of the larvae sampled on the Baie Verte Peninsula were parasitized and 2% infected with an undetermined yeast-like organism.

Branch samples were collected at 150 sample points in mid-October to forecast the 1991 outbreak. Eggs were extracted from these branches and the forecast based on the number of eggs/m^2 of foliage. The areas of light, moderate and severe defoliation for 1991 are forecast to be 77 500 ha including 39 300 ha in the moderate and severe category. The outbreak is expected in the same general areas as 1990, across the Northern Peninsula from St. Barbe to Roddickton (Table 4, Fig. 6).

Spruce Budworm
Choristoneura fumiferana

The only area of infestation by this insect in 1990 occurred on 2 200 ha between South Branch River and Codroy Pond (Table 5, Fig. 7).

Table 4. Areas (ha) of defoliation by the blackheaded budworm forecast in forested areas of Newfoundland in 1991.

Management Unit No.	Defoliation Class*		
	Light	Moderate and Severe	Total
17	5 600	16 300	21 900
18	32 600	23 000	55 600
Total	38 200	39 300	77 500

* Light = 6-25%
Moderate = 26-75%
Severe = 76-100%

Table 5. Areas (ha) of defoliation caused by the spruce budworm in forested areas of Newfoundland in 1990.

Management Unit No.	Defoliation Class*			
	Light	Moderate	Severe	Total
14	900	-	1 300	2 200
Total	900	-	1 300	2 200

* Light = 6-25%
Moderate = 26-75%
Severe = 76-100%

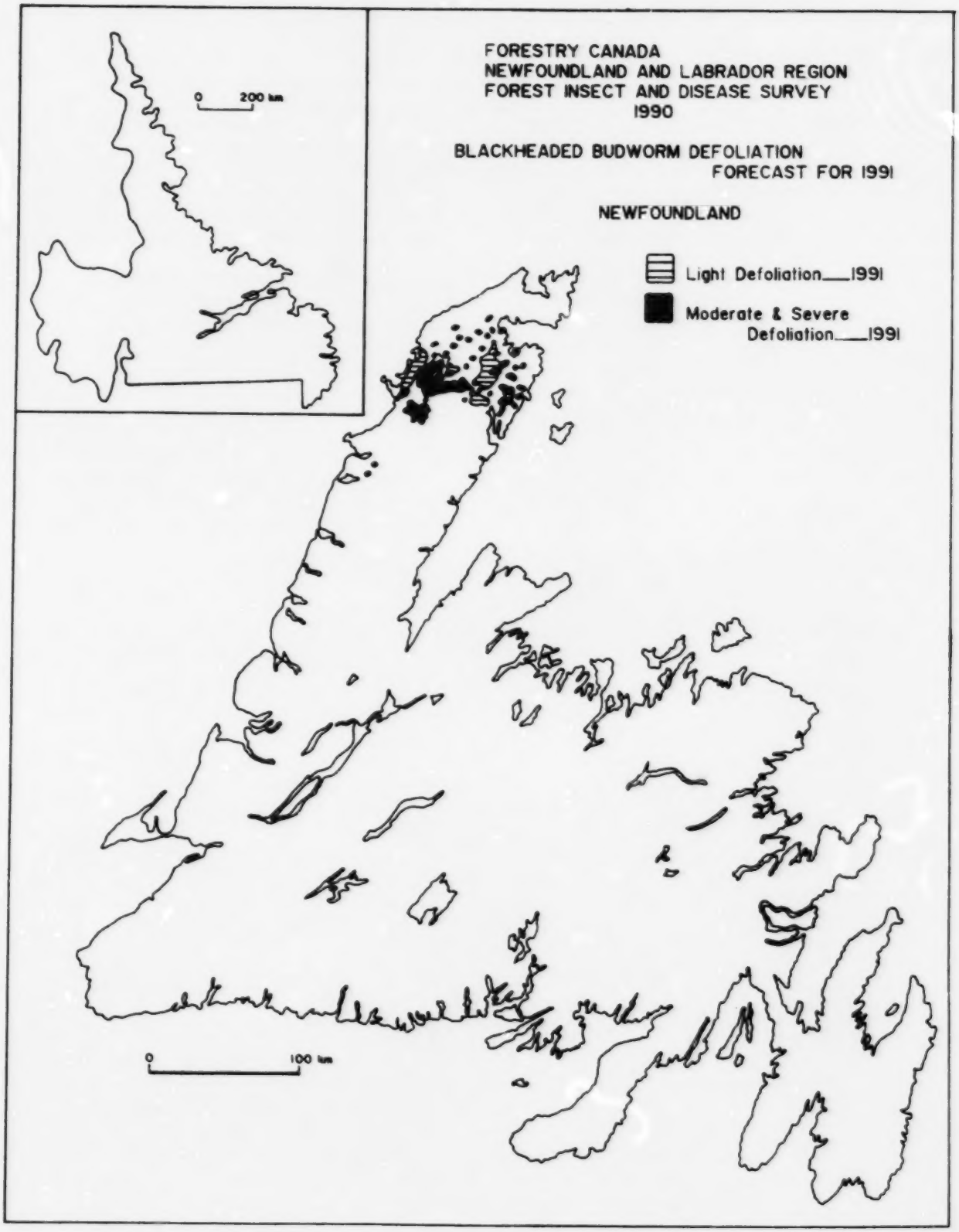

Figure 6. Areas of defoliation by the blackheaded budworm forecast in forested areas of Newfoundland for 1991.

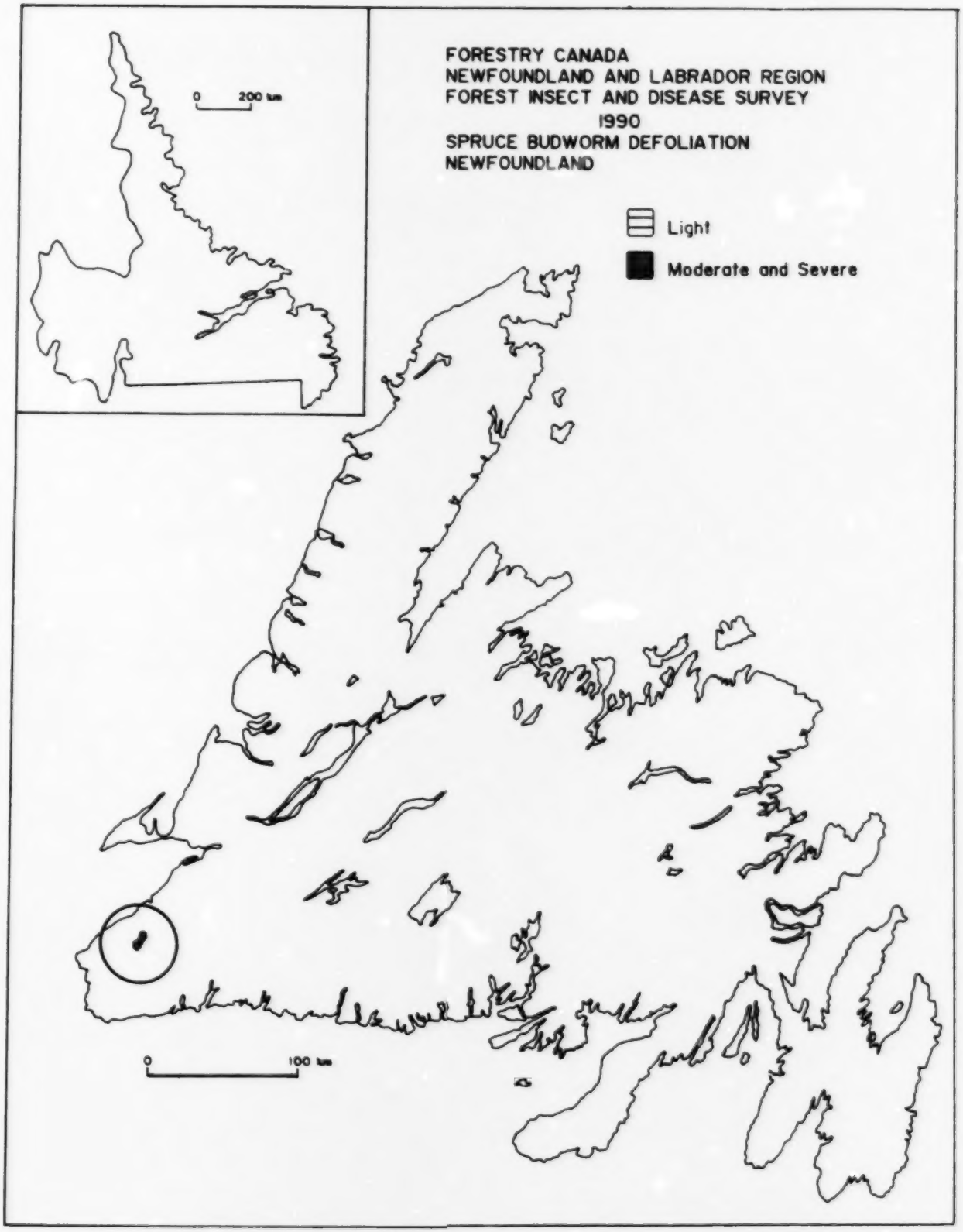

Figure 7. Areas of defoliation by the spruce budworm in forested areas of Newfoundland in 1990.

This was the second year of severe defoliation in this area and the size of infestation nearly doubled from that of 1989. The infestations near Molly Chignic Brook, LaScie Road and LaPoile River, active since 1981, terminated in 1990 and only low numbers of larvae were collected from these areas.

Data on biological mortality factors were collected from an endemic population on the LaScie Road and from the infestation near Codroy Pond. Larvae collected from the LaScie Road sustained 50% parasitism and 4% were infected with a disease. Only 4.5% of the larvae collected near Codroy Pond were parasitized and no disease was found in collections from the area.

The total number of male moths caught in pheromone traps at 50 locations (Fig. 8) decreased from 3,130 in 1989 to 1,452 in 1990 (Appendix I). The highest numbers trapped were along the west coast of the Island at Campbells Creek on the Port au Port Peninsula, 785 moths, and Sally's Cove, 266 moths. Traps near the infestation near Codroy Pond caught only 149 moths and traps placed throughout central Newfoundland had catches of only a few moths at four locations. A total of 36 moths were trapped near Clarenville and 14 and 10 at two locations on the Avalon Peninsula. The catches in eastern Newfoundland were the highest since trapping began in 1985.

Budworm egg numbers were surveyed in conjunction with those of the hemlock looper and blackheaded budworm in 386 sample points. The area of infestation forecast for 1991 is 33 300 ha including 5 800 ha of moderate and severe defoliation (Table 6, Fig. 9).

Table 6. Areas (ha) of defoliation caused by the spruce budworm forecast in forested areas of Newfoundland for 1991.

	Defoliation Class*		
Management Unit No.	Light	Moderate and Severe	Total
1	-	500	500
6	300	-	800
7	1 700	-	1 700
9	500	-	500
12	800	0	800
14	17 200	3 500	20 700
15	2 400	1 800	4 200
16	1 400	-	1 400
17	800	-	800
18	1 600	-	1 600
Total	26 700	5 800	32 500
GMNP	800	-	800
Grand Total	27 500	5 800	33 300

* Light = 6-25%
Moderate = 26-75%
Severe = 76-100%

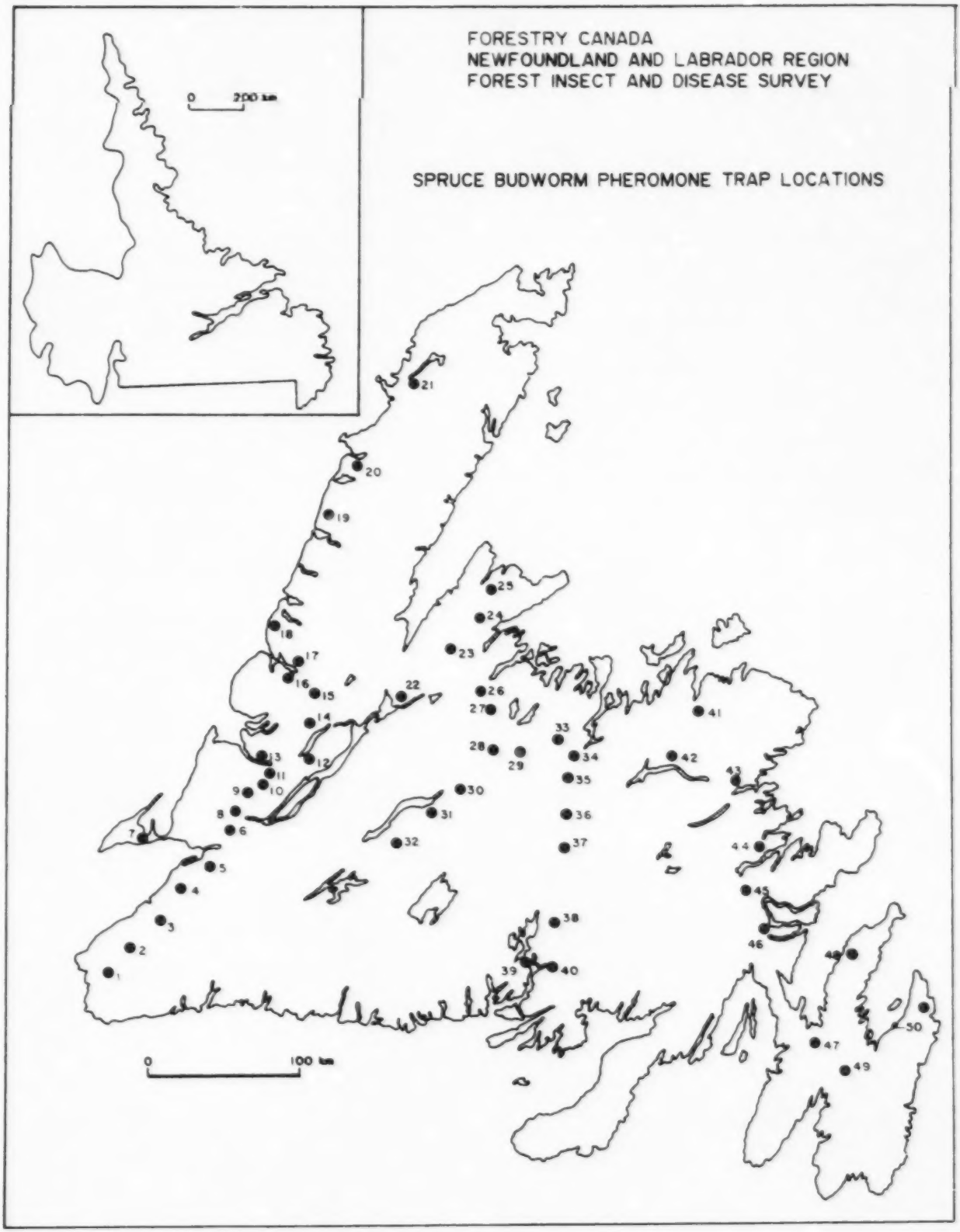

Figure 8. Spruce budworm pheromone trap locations.

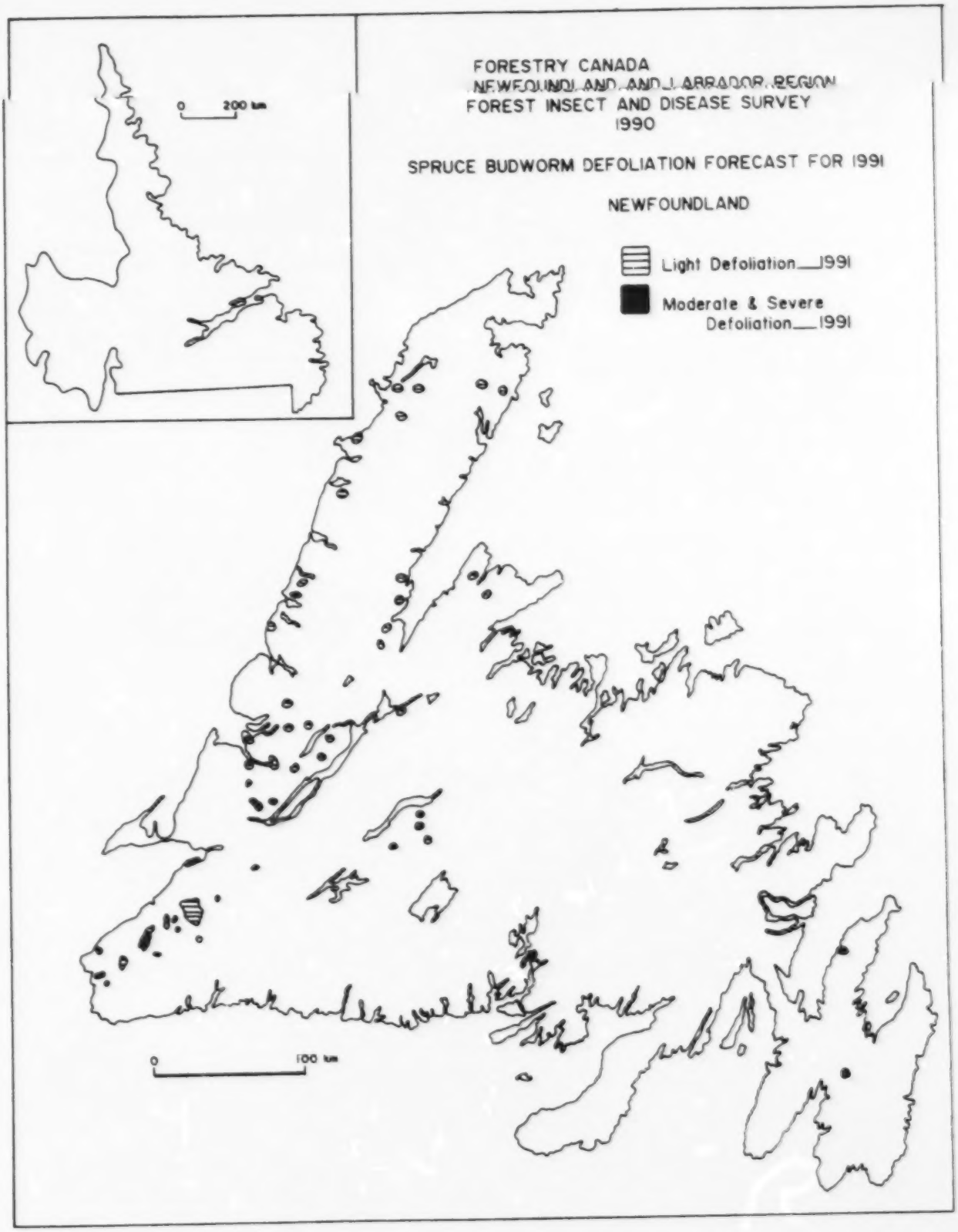

Figure 9. Areas of defoliation by the spruce budworm forecast in forested areas of Newfoundland for 1991.

Balsam Fir Sawfly
Neodiprion abietis

Severe defoliation in 1990 occurred along the lower Salmon River and in the St. Albans, Bay d'Espoir area for the second consecutive year. The infestation expanded into several river valleys and into the coastal forests. Thinned stands northeast of St. Albans were also infested (Table 7, Fig. 10). Two other infestations occurred on the Island, one near the junction of the Viking Trail and Roddickton roads and the second at Frenchman's Cove Provincial Park on the Burin Peninsula. However, defoliation was negligible in these two areas.

Tree mortality associated with sawfly feeding usually occurs only in association with damage by another defoliator. In the Bay d'Espoir area severe defoliation by this sawfly is expected in 1991 along with light defoliation by the spruce budworm. These areas should be closely monitored in 1991 to see if infestations by these two defoliators overlap.

Balsam Woolly Adelgid
Adelges piceae

In 1989 the Forest Insect and Disease Survey initiated a survey to determine the distribution of adelgid population levels for the Island. This survey was completed in 1990.

High populations of more than 10 adelgids/node occurred in isolated pockets in all regions of the Island (Fig. 11). The largest area of high populations occurred west of St. Georges River, and another high infestation has developed in western Newfoundland on the northern shores of Deer Lake. In central Newfoundland high infestations were recorded near Red Indian Lake and both east and west of Lewisporte. In western and central regions of the Island moderate population levels of 5 to 9 adelgids/node occurred in a few scattered locations. In the eastern region of the Island, east and south of Gander, population levels were generally more evenly distributed, with peaks of high population levels on the south shore of the Bonavista Peninsula, and two on the Avalon Peninsula. Moderate population levels were recorded at six locations including three on or near the Bonavista Peninsula.

Low populations of the adelgid of 0.1 to 4.9/node, occurred in numerous stands scattered in most of the areas surveyed (Fig. 11). No adelgids occurred on the Northern Peninsula north of Gros Morne National Park at the 70 locations sampled.

This survey is the first population survey for this insect in Newfoundland, and is the first attempt to establish a baseline data set. The results of future surveys can be compared to these results to judge population trends.

Yellowheaded Spruce Sawfly
Pikonema alaskensis

Larvae of this sawfly occurred in several plantations in central Newfoundland. Most plantations had low population levels, but a few near Sunday Pond contained high population levels. These plantations should be checked early in 1991 to see if protection is required.

Table 7. Areas (ha) of defoliation caused by the balsam fir sawfly in forested areas of Newfoundland in 1990.

Management Unit No.	Defoliation Class*			
	Light	Moderate	Severe	Total
7	1 000	500	3 800	6 200
Total	1 000	500	3 800	6 200

* Light = 6-25%
Moderate = 26-75%
Severe = 76-100%

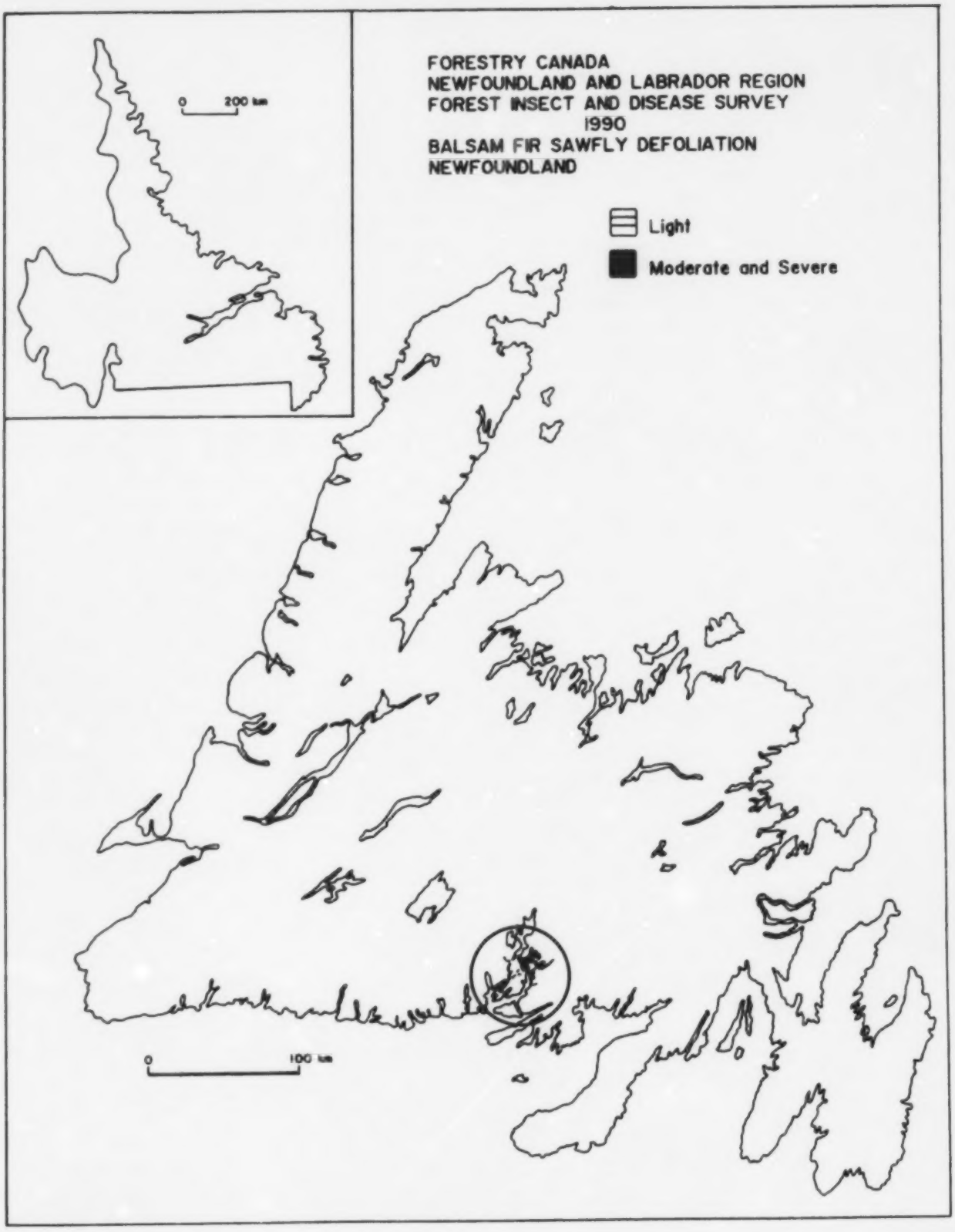

Figure 10. Areas of defoliation by the balsam fir sawfly in forested areas of Newfoundland in 1990.

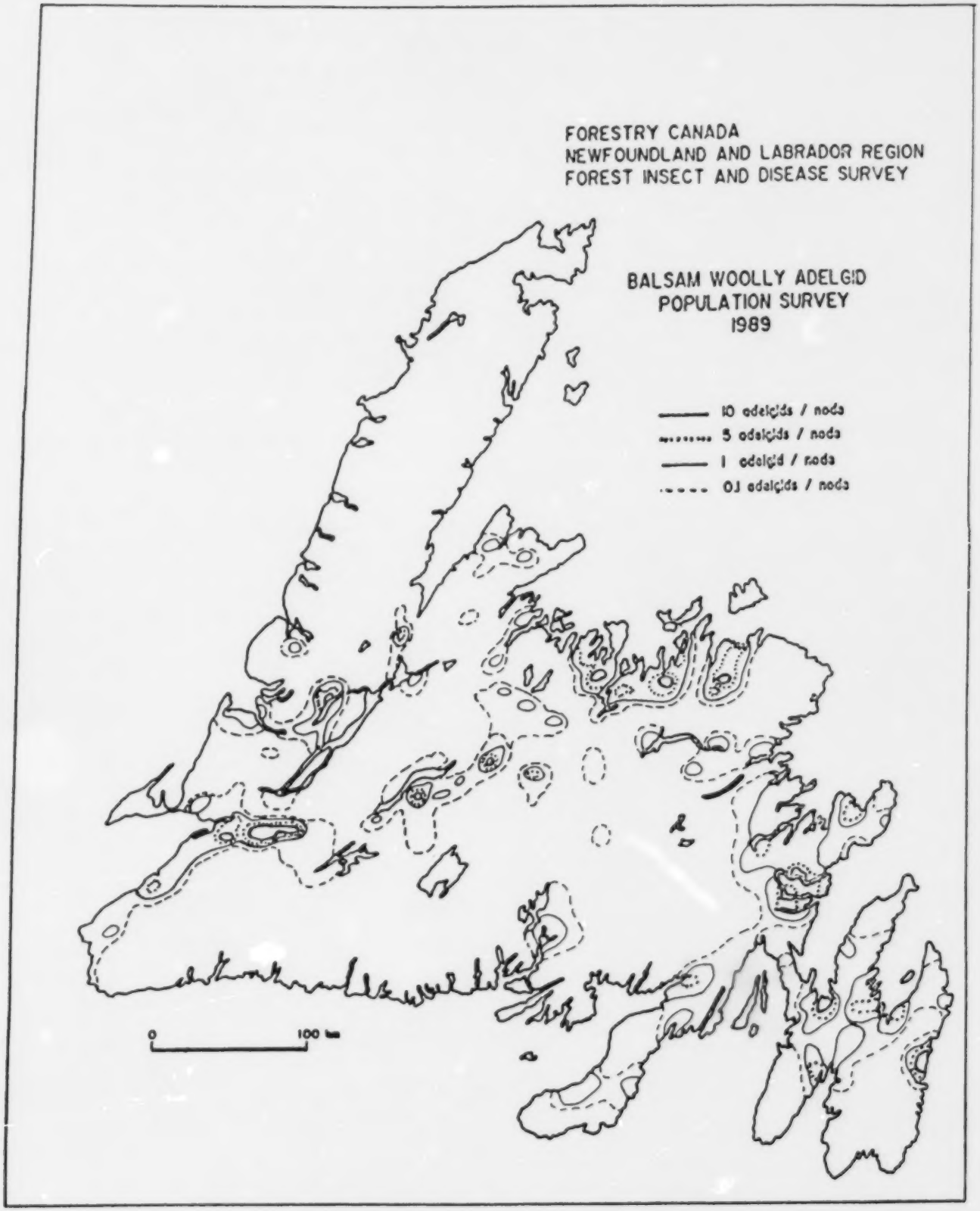

Figure 11. Population densities of overwintering balsam woolly adelgids in Newfoundland in 1989 and 1990.

Spruce Budmoth
Zeiraphera canadensis

This budmoth attacks the current foliage of white and black spruce and can cause leader and shoot mortality. In 1990 severe defoliation was recorded in a precommercially thinned stand near Pinchgut Lake and on open grown trees along farm roads near St. Andrews in western Newfoundland. Light to moderate defoliation also occurred in other areas near Norris Arm and Harry's Harbour; near Conception Harbour, Makinsons, Brigus, Clarkes Beach, Carbonear and St. John's.

Black Army Cutworm
Actebia fennica

Population levels in 1990 were low in plantations and areas burnt by wildfires. The only damage occurred at Pynn's Brook in an area planted after a prescribed burn, where terminal buds on several black spruce seedlings were destroyed.

Pheromone-baited traps placed in several burned areas caught low numbers of moths in the older infestation in the Fischells River area, but high numbers in areas burnt by wildfire at Fischells River, Bellburns and in areas of a prescribed burn at Northeast Pond and near Pynns Brook. Based on these trap-catch data light to moderate population levels are forecast for these areas in 1991.

European Pine Sawfly
Neodiprion sertifer

Moderate to high population levels of this sawfly continued on pine trees on the campus of Memorial University and in other areas throughout St. John's and Mount Pearl. Good control was achieved of all infestations sprayed with a virus. The same virus had been sprayed in past years, but natural spread is hindered by the disjunct distribution of the host trees of the sawfly. Nevertheless evidence of natural spread of the virus was observed in 1990 for the first time.

Spruce Budscale
Physokermes piceae

High numbers of the budscale occurred in plantations in central Newfoundland and in stands near Charlottetown Jct. and Dunphy's Pond Road in Terra Nova National Park. About 20-70% of the foliage was damaged. Most damage occurred on black spruce trees planted on poorer sites that were also stressed by drought.

Larch Sawfly
Pristiphora erichsonii

There were no major outbreaks of the sawfly in the Province in 1990. A small area of light defoliation occurred near Paddy's Pond on the Avalon Peninsula. The infestation near Avondale, active since 1986, collapsed in 1989. Shrew trapping in the four permanent plots across the Island showed a decrease in population levels compared to past years (Table 8). The cause of this decrease is not known.

Table 8. Estimated number of shrews per hectare from 1985-90 in Newfoundland.

Location	1985	1986	1987	1988	1989	1990
St. Georges	3.21	2.15	1.09	6.44	4.30	1.09
Halls Bay	3.21	2.15	2.15	5.73	3.21	0.97
Terra Nova National Park	-	6.42	3.24	5.73	6.44	0.97
Paddy's Pond	2.15	5.39	4.30	-	8.60	0.00

Larch Casebearer
Coleophora laricella

Small patches of severe defoliation by this casebearer occurred in young stands of larch along Camp 180 road near Jeffreys, near Flatwater Pond, along the Burlington Road on the Baie Verte Peninsula, along Southside Road southeast of Grand Falls and along Thorburn Road in St. John's.

Larch Beetle
Dendroctonus simplex

Population levels of the eastern larch beetle are increasing in eastern Newfoundland. Areas of successful beetle attack, as indicated by premature yellowing of the foliage, occurred from Paddy's Pond to Butterpot Park; near Chapel Arm and along Pipers Hole River near Swift Current.

This is the first evidence of an increasing population since 1978 when the first recorded outbreak began.

Four-Eyed Spruce Bark Beetle
Polygraphus rufipennis

High population levels of this beetle were recorded in a small black spruce stand in the Stony Brook area near Grand Falls. The beetle caused tree mortality in several stressed trees on the edge of a small residual black spruce stand.

Birch Casebearer
Coleophora serratella

Severe infestations of the casebearer continued in 1990 in several areas throughout the Island. Severe defoliation of white birch was reported in many areas from St. Andrews to Wiltondale, throughout the Baie Verte Peninsula, from Springdale to Badger, from Lewisporte to Gander Bay, and from Clarenville to Deep Bight. Damage also occurred in several provincial parks in central and eastern Newfoundland, and in Terra Nova National Park.

Mountain-ash Sawfly
Pristiphora geniculata

Low to high populations of this insect were recorded throughout eastern and western Newfoundland. Defoliation ranged from light to moderate. A parasite of this sawfly was introduced from Quebec in 1981 to the St. John's area and has become established. This parasite has been translocated to the Pasadena area and has become established in that area as well.

Gypsy Moth
Lymantria dispar

Pheromone-baited traps were placed at 250 locations throughout the Island in cooperation with Agriculture Canada, to detect accidental introduction of this pest to the Island. Forestry Canada places traps at 9 locations (Fig. 12). Three male moths were caught in 1990, one in Port au Basques and two in St. John's. Trap catches at both localities were in parks, indicating the larvae may have been brought to Newfoundland on recreational vehicles. These areas should be closely monitored for larvae in 1991 to see if female moths were also introduced.

Forest Tent Caterpillar
Malacosoma disstria

A total of 100 pheromone-baited traps were placed in parks, camping areas and near towns in 17 permanent sampling areas (Fig. 13) to collect moths that might have been accidentally introduced to the Island. However, no moths were caught in these traps in 1990.

Predaceous Wasps
Vespidae

Several species of Vespidae (wasps) are efficient predators of caterpillars on tree foliage. The wasps hunt caterpillars, paralyze them, and provision their nests with them. Studies on the mainland have demonstrated that several species of these wasps also prey on the spruce budworm, and can remove a very high proportion of budworm larvae from a tree when the budworm population levels are very low. Thus they may be important in maintaining low budworm population levels.

Wooden blocks, with holes of the right size, are suitable artificial nesting sites for the wasps and are very efficient samplers to detect the presence of predaceous wasp species.

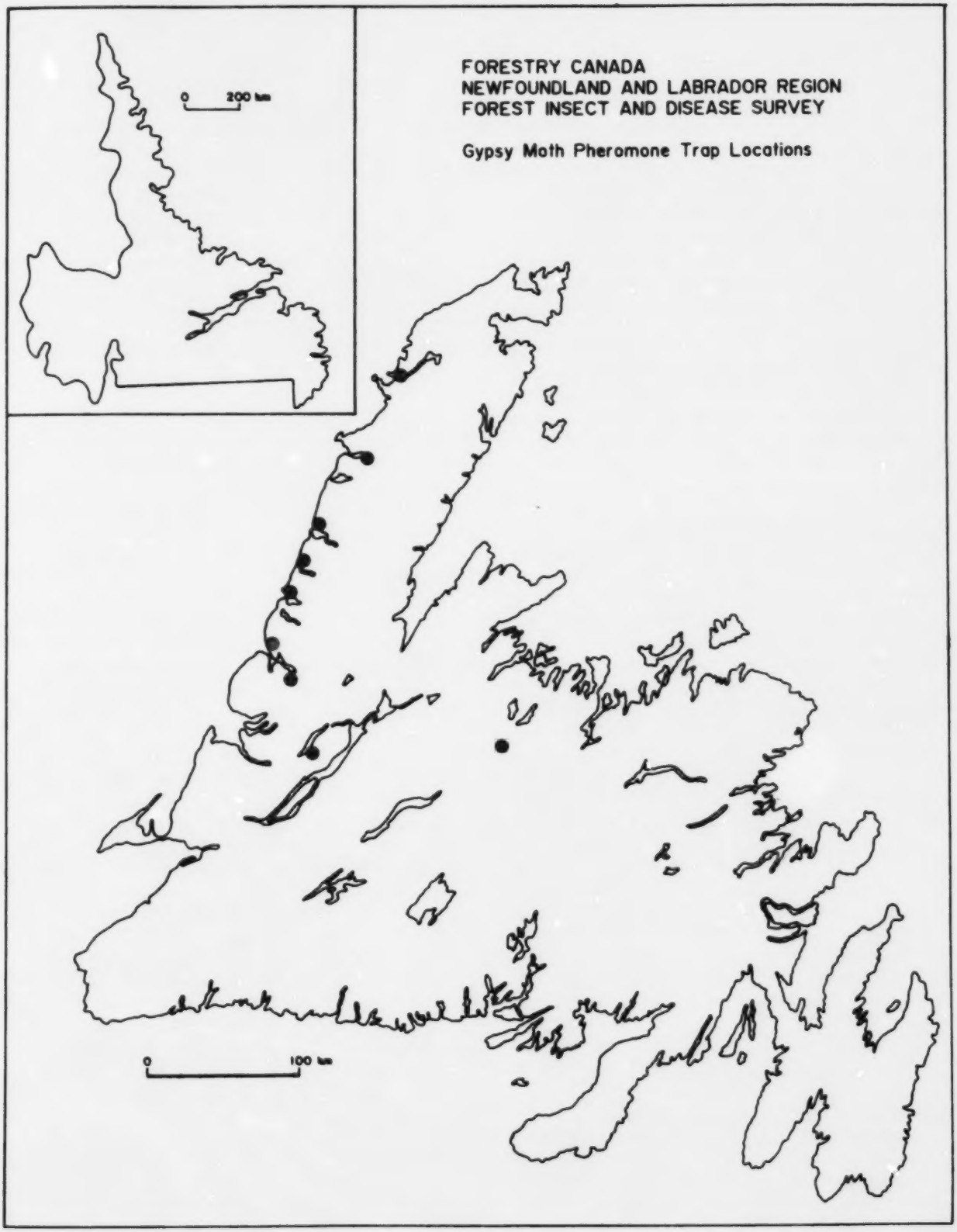

Figure 12. Gypsy moth pheromone trap locations (placed by Forestry Canada).

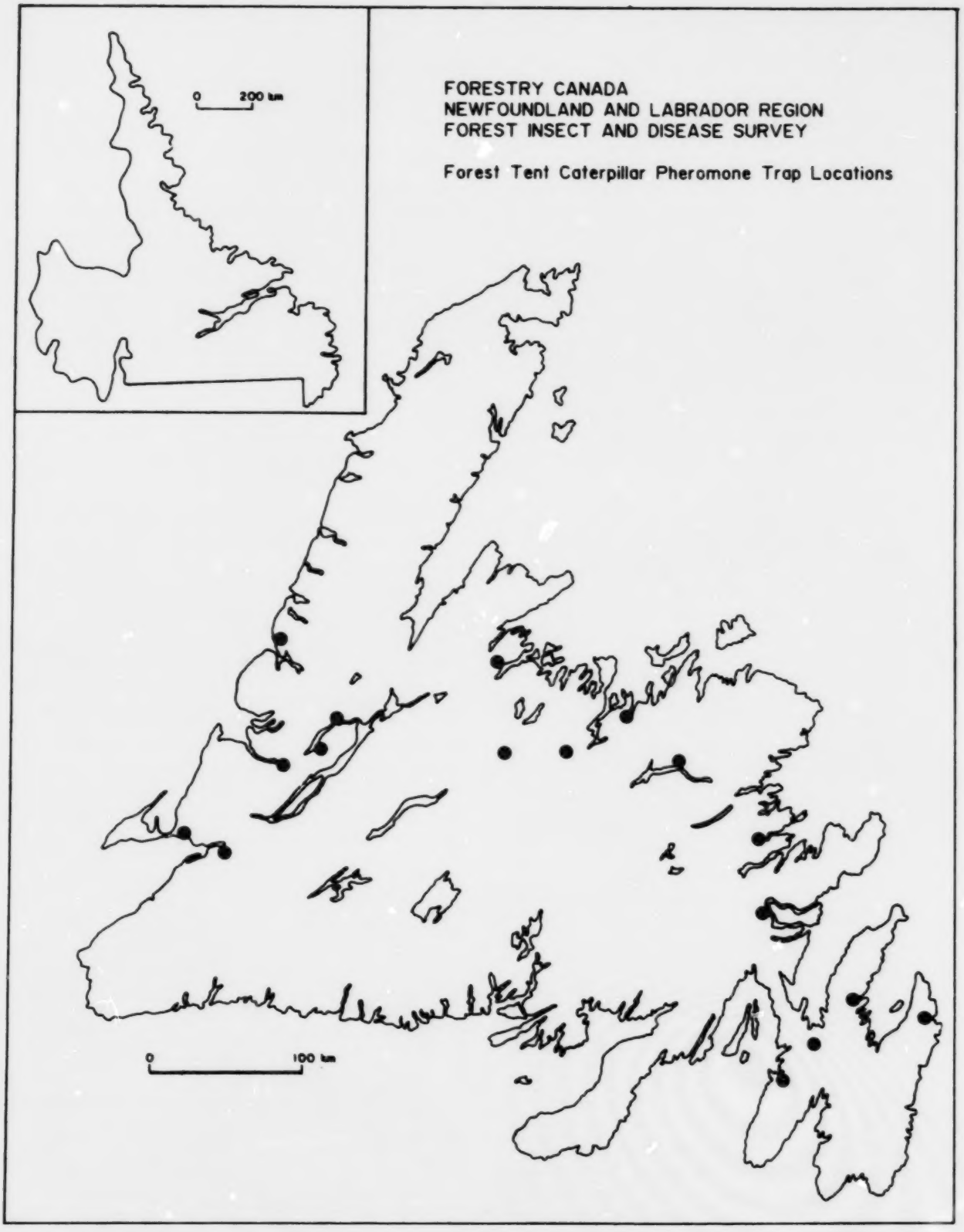

Figure 13. Forest tent caterpillar pheromone trap locations.

Several blocks were placed near hemlock looper and spruce budworm infestations in Newfoundland in 1990. They were placed in June and collected after budworm pupation was completed. None of the traps had been used by wasps to construct nests, and we concluded that predaceous wasp species may not occur in Newfoundland or are very rare.

DISEASES

Shoe-String Root Rot
Armillaria Species

Armillaria root rot was collected on dying balsam fir and black spruce roots in the Naskaupi River Valley in Labrador, but the fungus was not the cause of death. However, one pine sapling in a 3 m tall jack pine stand of seeded origin near the Caribou River in Labrador was killed by this fungus. Pine plantations in Labrador should be closely monitored because of their susceptibility to this disease. Armillaria was also recorded on black spruce in several localities in central Newfoundland where chlorotic and dead trees were observed. This root rot affected mature balsam fir trees on Thorburn Road near St. John's where site disturbance was also a factor.

Scleroderris Canker
Gremmeniella abietina

In 1990 Scleroderris canker was recorded at several previously infected locations on the Avalon Peninsula. In the plantation at Colliers Ridge 15% of the shoots on Scots pines were affected and in an old plantation on the Salmonier Line, several Scots pines had died or were dying. The disease was also recorded in St. John's but only scattered shoots were infected. The Sitka spruce plantation on the Northern Peninsula, sanitized in 1987, had a recurrence of symptoms in 1990.

Eastern Dwarf Mistletoe
Arceuthobium pusillum

This mistletoe continued to spread from old affected black spruce to other trees in the study plot near Gambo. More than 35% of the trees in the plot have become affected in the last eight years.

Needle Rust of Spruce
Chrysomxa ledicola

This disease was common and widespread throughout the Avalon Peninsula. Approximately 80% of the new foliage of white spruce was affected in three sites in a six-year-old plantation near Ocean Pond. Up to 50% of the foliage of white spruce was also infected at Colliers.

About 80% to 100% of the new foliage of white spruce was affected at the junction of White's Road and Hansen Highway near Stephenville Crossing in western Newfoundland and near Winterland on the Burin Peninsula. About 20% of black spruce foliage was infected in a small stand near Conne Pond, Bay d'Espoir.

Broom Rust of Balsam Fir
Melampsorella caryophyllacearum

A high incidence of broom rust was observed along Robin Hood Bay road near St. John's. Up to 50% of the balsam fir trees in the stand were infected and many new brooms were formed. The infestations near St. Thomas and St. Phillips continued at the same level of infection for the second consecutive year. A low level of infection of rust was recorded on black spruce along the Churchill Road in Labrador.

Septoria Leaf Spot
Septoria betulae

A moderate to high incidence of this disease caused 40% to 90% damage to the foliage of white and yellow birch in western Newfoundland. Several areas were affected near Cold Brook, Stephenville and along the Grand Lake and Little George's Lake Roads.

Leaf and Shoot Blight
Venturia macularis

This disease affected trembling aspen and balsam poplar trees throughout the Province. Severe damage occurred to balsam poplar in Port Saunders on the Northern Peninsula and along with other causes (drought) resulted in some tree mortality. About

70% of the aspen regeneration was affected near Cobblers Brook in Terra Nova National Park, and lower incidences of the disease occurred near Westport on the Baie Verte Peninsula and near Deer Lake in western Newfoundland. Poplar trees were also damaged near St. Thomas on the Avalon Peninsula.

Taphrina Witches' Broom
Taphrina cerasi

Taphrina witches' broom of pin cherry was common in and around St. John's, along the South Brook Valley Road and, South Branch Road in western Newfoundland and near North West River in Labrador.

Willow Blight
Fusicladium saliciperdum

Willow blight was common and widespread in and around St. John's, with up to 80% of the foliage affected. Most of the ornamental golden willows throughout the town of Gambo were also severely affected. The disease was also common on willows near Glenwood in central Newfoundland, and near Upper Gullies and Chamberlains on the Avalon Peninsula.

ANIMALS

Moose - severe damage by moose to young balsam fir stands, including stands recently thinned occurred in the Sunday Pond road area in central Newfoundland for the second consecutive year. Moose also caused damage to young balsam fir trees at Malady Head in Terra Nova National Park and in numerous scattered areas in central and western Newfoundland. **Beaver** - damage to birch and aspen in eastern Newfoundland was frequent. **Meadow vole** - high populations of the meadow vole caused severe damage and mortality of many young ornamental trees in Happy Valley/Goose Bay, Labrador, in the tree nursery in Goose Bay and in 1 year old pine plantations in the Goose Bay area. **Red squirrels** - damage continued to the tips of black spruce trees in many parts of the Island and throughout Labrador. Twigs are torn from the stem as squirrels remove the cones, giving the tree tops a distinctive tufted appearance. **Porcupine** - light damage (girdling) occurred to spruce and fir in eastern Labrador.

ABIOTIC DAMAGE

Late Spring Leaf Scorch - A high incidence of late spring leaf scorch was recorded on speckled alder at Western Arm on the Baie Verte Peninsula and near Charleston, Bonavista Bay. Up to 15% of the foliage of maples and horse chestnuts in St. John's was also affected.

Winter Drying - Numerous records of winter drying of foliage were reported throughout the Province on several tree species: balsam fir in exposed areas along the Northern Peninsula highway north of Portland Creek, near Daniels Harbour and near Parsons Pond; **black spruce** - severe damage occurred to stands in Notre Dame Provincial Park, Terra Nova National Park and at Old Gull Lake in Labrador. **Sitka spruce** - severe damage, from 40% to 100% of the trees in plantations on Crescent Lake Road, near Pynn's Brook, near Pasadena and near Roddickton. **Pines** - severe damage on up to 70% of the trees in plantations near New Melbourne along the Fischells River in western Newfoundland, and on the Avalon Peninsula near Avondale and along Back River and in Deer Park on the Salmonier Line and moderate damage to seedlings along the Churchill River road in Labrador. Light damage occurred to ornamental pines in eastern Newfoundland along the Conception Bay highway, Upper Gullies, at Hearts Delight, Pouch Cove and in St. John's.

OTHER INSECTS AND DISEASES

Insect, disease or damage	Host(s)	Location	Remarks
Anthracnose *Kabatiella apocrypta* (Ell. and Ev.) Arx	Maples	Western Newfoundland Avalon Peninsula	Up to 10% of the foliage affected on roadside trees in Gros Morne National Park and on ornamentals on the Avalon Peninsula.
Apple scab *Venturia inaequalis* (Cooke) Wint.	Crab apple Flowering crab	Avalon Peninsula	Up to 100% of the foliage affected on some urban trees.
Balsam twig aphid *Mindarus abietinus* Koch.	Balsam fir	Western Newfoundland Eastern Labrador	Low to moderate populations. Light damage.
Birch leafminer *Fenusa pusilla* (Lep.)	White birch Speckled alder	Western Newfoundland Burin Peninsula	Populations and damage levels varying from low to very high.
Black knot *Apiosporina morbosa* (Schw.) Arx	Pin cherry Plum	Throughout Newfoundland	High incidence in western Newfoundland with occasional tree mortiality of pin cherry.
Broom rust *Chrysomyxa arctostaphyli* Diet.	Black spruce	Eastern Labrador	Widely scattered trees with brooms.
Cytospora canker and dieback	Mountain maple mountain-ash	Western Newfoundland	Common on European mountain-ash at Pasadena Field Station.
Cytospora chrysosperma (Pers.) Fr.	American mountain-ash	Avalon Peninsula	Severe incidence on American mountain-ash near St. John's.
Eastern spruce gall adelgid *Adelges cooley* Gill.	Sitka spruce	Pasadena	Trace of damage.
European alder leafminer *Fenusa dohrnii* (Tischb.)	Speckled alder	Western Newfoundland	Populations low and defoliation generally light, except severe damage to a few tree clusters.

OTHER INSECTS AND DISEASES (Cont'd.)

Insect, disease or damage	Host(s)	Location	Remarks
European spruce sawfly *Gilpinia hercyniae* (Htg.)	White spruce Black spruce	Western and central Newfoundland, Burin Peninsula and eastern Labrador	Low numbers and no significant defoliation.
Fall webworm *Hyphantria cunea* (Drury)	Speckled alder White birch Willow	Western Newfoundland	Nests numerous throughout the Black Duck - Stephenville area.
Frost damage	Black spruce Speckled alder	Western and central Newfoundland	100% of the new foliage of black spruce seedlings in a plantation in central Newfoundland.
Gray mold blight *Botrytis cinerea* Pers.	Black spruce White spruce Hicks yew Lilac	Western Newfoundland Avalon Peninsula	Approximately 10% of 3 + 0 container seedlings of white spruce affected near St. George's in western Newfoundland. Light incidences on lilac on the Avalon Peninsula.
Greenheaded spruce sawfly *Pikonema dimmockii* (Cress.)	Black spruce White spruce Balsam fir	Western and central Newfoundland, and eastern Labrador	Low numbers, no significiant damage.
Ink spot *Ciborinia whetzelii* (Seav.) Seav.	Trembling aspen	Central Newfoundland	A high incidence.
Large aspen tortrix *Choristoneura conflictana* (Wlk.)	Trembling aspen Balsam poplar	Western and eastern Newfoundland	Severe defoliation on trembling aspen in Terra Nova National Park.
Leaf blister *Taphrina populina* Fr.	Lombardy poplar	St. John's	Trace of damage.
Leaf blotch *Guignardia aesculi* (PK.) V.B. Stewart	Horse chestnut	St. John's	Up to 80% of the foliage affected but generally trace of damage.
Leaf and shoot blight *Pollacia elegans* Serv.	Balsam poplar	Northern and Avalon Peninsulas	High incidences, especially in urban areas.
Melampsora abieti-capraearum Tub.	Willow	Northern Peninsula	Leaf browning and wilting.

OTHER INSECTS AND DISEASES (Cont'd.)

Insect, disease or damage	Host(s)	Location	Remarks
Melampsora abietis-canadensis Ludwig ex Arth.	Trembling Aspen	St. John's	40% of the foliage affected.
Leaf spot *Marssonina brunnea* (Ell. and Ev.) Sacc.	Trembling Aspen	Avalon Peninsula	Low incidence
Mourning cloak butterfly *Nymphalis antiopa*	Willow	Western, central and eastern Newfoundland	Low to high numbers. Damage variable, from light to severe.
Nectria dieback and canker hardwoods *Nectria cinnabarina* Tode ex Fr.	Hardwoods	Western Newfoundland and near St. John's	Dieback of trees with up to 10% of the lower branches affected.
Nectria galligena Bres.	Sycamore maple	St. John's	Infection on stem causing death of tree.
Needle cast *Isthmiella faullii* (Darker) Darker	Balsam fir	Avalon Peninsula	Low incidence.
Lophodermium pinastri (Schrad. ex Fr.) Chev.	Jack pine	Bonavista Peninsula	Low incidence on planted pine.
Rhizosphaera kalkhoffii Bubak	Blue spruce	St. John's	Low incidence
Needle rust *Chrysomyxa empetri* Schroet.	White spruce	Western Newfoundland Burin and Avalon Peninsulas	Generally low incidence, but high on 2 ha on the Avalon Peninsula.
Chrysomyxa ledi de Bary	Black spruce White spruce	Western and central Newfoundland Avalon Peninsula	Generally low incidence but high on black spruce in some areas in western Newfoundland
Coleosporium asterum (Diet.) Syd.	Jack pine	Bonavista and Avalon Peninsulas	Up to 15% of the foliage affected.
Milesia fructuosa Faull	Balsam fir	Burin Peninsula	Low incidence.
Pucciniastrum epilobii Otth	Balsam fir	Avalon Peninsula	5% of the foliage affected.
Orange spruce needle miner *Coleotechnites piceaella* (Kft)	Balsam fir	Western and eastern Newfoundland.	Low numbers.

OTHER INSECTS AND DISEASES (Cont'd.)

Insect, disease or damage	Host(s)	Location	Remarks
Phomopsis blight *Phomopsis* juniperovora Hahn.	Norther white cedar Juniper	Avalon Peninsula	Low incidence.
Physalospora miyabeana Fukushi	Willows	Central and eastern Newfoundland	Trees on the Avalon Peninsula severely infected, up to 80% of foliage affected.
Poplar serpentine leafminer *Phyllocnistis populiella* (Cham.)	Trembling aspen Silver poplar Balsam poplar Speckled alder	Western and central Newfoundland and eastern Labrador	Low populations. Defoliation generally light. Severe damage to trembling aspen at one location in western Newfoundland.
Red flagging *Fusicoccum abietinum* (Hartig) Prill. and Del.	Balsam fir	Western Newfoundland	Branch tips bare, generally, low incidence.
Rusty tussock moth *Orgyia antigua* (L.)	Balsam fir Black spruce Speckled alder	Western and central Newfoundland	Populations low. No significiant damage.
Satin moth *Leucoma salicis* (L.)	Trembling aspen Silver poplar Willow	Western and central Newfoundland	Severe infestation on ornamentals throughout Fleur de Lys on the Baie Verte Peninsula.
Shot hole *Coccomyces hiemalis* Higgins	Pin cherry	Western Newfoundland Avalon Peninsula	Up to 20% of the foliage affected.
Site disturbance	Tamarack Larch Black spruce	Western Newfoundland St. John's	Severe damage on several roadside trees.
Spruce coneworm *Dioryctria reniculloides* M.&M.	White spruce Black spruce Balsam fir	Western and central Newfoundland	Populations low. No significant damage.
Spruce spider mite *Oligonychus ununguis* Jac.	Blue spruce	St. John's	High populations locally.
Tar spot *Rhytisma ilicis - canadensis* Schw.	Mountain holly	Avalon Peninsula	Low incidence.

OTHER INSECT AND DISEASES (Concl'd)

Insect, disease or damage	Host(s)	Location	Remarks
Tip blight *Diplodiapinea* (Desm.) Kickx	Scots Pine	Avalon Peninsula	5% of the lower foliage affected.
Uglynest caterpillar *Archips cerasivoranus* (Fitch.)	Choke cherry	Western Newfoundland	Number of nests decreased from previous year.
Whitemarked tussock moth *Orgyia leucostigma* (J.E. Smith)	Balsam fir	Western Newfoundland Avalon Peninsula	Very low numbers.
Willow blight *Physalospora miyabeana* Fukushi	Willows	Central and eastern Newfoundland Avalon Peninsula Mt. Pearl St. John's	Trees in the Mt. Pearl and St. John's areas severely affected, with up to 80% of the foliage affected.

APPENDIX

Locations of pheromone - baited* traps in Newfoundland in 1990, and the total number of larvae (per 3 tree samples) in June the total number of male moths (per 3 traps) and the total number of overwintering larval (per 3 branches) in October.

Plot No.	Location	No. Larvae	No. Adults	No. Overwintering Larvae
1	Overfalls Brook	7	1	3
2	Codroy Pond	94	149	3
3	Mitchells Pond	0	3	0
4	Fischells River	1	5	0
5	Barachois Brook	0	14	2
6	Trout Brook	0	18	1
7	Campbells Creek	0	785	4
8	Gallants Road	0	0	0
9	George's Lake	1	1	0
10	Pinchgut Lake Road	0	0	0
11	Corner Brook Stream	0	4	1
12	South Brook Valley	0	2	0
13	Bay of Islands	7	21	5
14	Goose Arm Road	0	2	2
15	Big Bonne Bay Pond	0	0	1
16	Lomond	0	0	0
17	East Arm, Bonne Bay	1	12	2
18	Sally's Cove	3	266	5
19	Daniel's Harbour	1	37	2
20	Hawkes Bay	3	44	1

Plot No.	Location	No. Larvae	No. Adults	No. Overwintering Larvae
21	Ten Mile Lake	0	5	0
22	Birchy Lake	0	0	4
23	Black Brook	0	0	0
24	Burlington Road	0	0	2
25	LaScie Road	1	1	0
26	West Brook Road	-	0	0
27	Gullbridge Mines Road	-	0	0
28	3 km W of Catamaran Park	-	0	0
29	Aspen Brook Road	-	3	2
30	Buchans Highway	-	0	2
31	5.3 km S of Exploits Dam	-	0	4
32	Quinn Lake	-	-	1
33	New Bay Pond Road	-	2	0
34	1.4 km E of Exploits River, Grand Falls	-	5	0
35	Tote Brook		-	1
36	Bay d'Espoir Highway, 9.1 km S, Northwest Gander River Bridge	-	0	2
37	Bay d'Espoir Highway at Gull Pond	-	0	4
38	Twillick Brook	-	2	0
39	St. Joseph's	-	12	5
40	Burnt Woods Road, Bay d'Espoir	-	0	2
41	Gander Bay Road	0	3	0

Plot No.	Location	No. Larvae	No. Adults	No. Overwintering Larvae
42	Glenwood	-	0	1
43	Gambo	-	5	0
44	8.6 km E Charlottetown Jct., TNNP	-	1	1
45	Thorburn Lake	-	0	0
46	TCH, 1.2 km W Hillview Jct.	-	36	1
47	Whitbourne	0	14	2
48	Heart's Content	0	10	11
49	Salmonier Line	-	5	19
50	Logy Bay	1	0	2

* "Biolure" used in 1990